

REMARKS

Further and favorable reconsideration is respectfully requested in view of the foregoing amendments and following remarks.

Thus, the specification has been amended, on pages 7 and 9, to overcome the objection to the disclosure, rendering this objection moot.

The Brief Description of the Drawings on pages 10-11 has been amended to use --stain resistant-- instead of "stainproofing", consistent with the rest of the disclosure and the claims.

Claims 11 and 24 have been cancelled.

Claims 5, 6, 16, 17 and 22 have been amended in a manner which, in conjunction with the corresponding amendments in the specification, overcomes the rejections of these claims under the first paragraph of 35 U.S.C. §112, rendering these rejections moot.

Claim 1 has been amended to limit the ceramic product to sanitary chinaware, considering the disclosure, for example, on page 1 of the specification. Amended claim 1 also incorporates the subject matter of claim 11, which has now been cancelled. The term "composed of" in line 2 of claim 1 has been changed to --comprising--, consistent with line 3 of original claim 12. Amended claim 1 also states that the hydroxyl group is combinable with soluble silica, based on the disclosure in the first paragraph on page 2 of the specification.

Claim 12 has been amended in a manner similar to amended claim 1, as a result of which claim 24 has been cancelled.

Other claims have been amended to be consistent with the claims from which they depend.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached pages are captioned "Version with markings to show changes made."

The patentability of the present invention over the disclosures of the references relied upon by the Examiner in rejecting the claims will be apparent upon consideration of the following remarks.

The rejection of claims 1-5, 7, 9-16, 18 and 20-24 under 35 U.S.C. §102(a) as being anticipated by Mizuno et al. (JP 2000-265526), as well as the rejection of claims 6, 8, 17 and 19 under 35 U.S.C. §103(a) as being unpatentable over Mizuno et al. and the rejection of claims 22 and 23 under 35 U.S.C. §103(a) as being unpatentable over Asai et al. in view of Mizuno et al., are respectfully traversed.

Each of these rejections relies on the Mizuno et al. reference alone or combined with another reference, but the Mizuno et al. reference is not available as prior art against the present invention since it was published September 26, 2000, which is after the filing date of March 23, 2000 for Applicants' PCT application on which the present U.S. application is based. Accordingly, all of these rejections should be withdrawn for this reason alone.

The rejection of claims 1-22 and 24 under 35 U.S.C. §103(a) as obvious over Asai et al. in view of Applicants' admitted prior art is respectfully traversed.

In connection with a discussion of the background of the present invention, as pointed out in the specification, a sanitary chinaware such as flush toilets or wash basins are clean when new. However, the glazed surface of the sanitary chinaware becomes dirty as the sanitary chinaware is used with water for a long period of time. It was conventionally considered that human waste adhered to the glazed surface with water and thereafter dried into stain. Accordingly, the prior art proposed to apply a water repellent treatment to the glazed surface so that the human waste and water were prevented from remaining on the glazed surface.

However, the present inventors found that the stain on the sanitary chinaware was a combination of a hydroxyl group present on the glazed surface with components of the human waste, etc. and not the dried human waste, etc. remaining on the glazed surface. Furthermore, the inventors found that the combination of the hydroxyl group with the components of the human waste, etc. was made via dehydration or dehydrogenation between the hydroxyl and metal ions in the water. Of such metal ions, soluble silica is particularly considered to be deposited as silicic acid with a network structure or silicic scale which is apt to incorporate stain. The inventors confirmed this regarding service waters and mineral waters which were obtained from all over Japan (Tables 1 to 4 in the specification).

The sanitary chinaware in accordance with the present invention employs a stain resistant agent which includes a silicon-containing functional group previously combined, by dehydration or dehydrogenation, with a hydroxyl group which is combinable with soluble silica and is present on the treated surface of the chinaware which is to be repeatedly wetted and dried.

More specifically, in the sanitary chinaware and the method of stain resistant treatment in accordance with the present invention, before the hydroxyl group on the treated surface can combine with soluble silica in the water, the silicon-containing functional group of the stain resistant agent is

previously caused to combine with the hydroxyl group, thereby shielding the hydroxyl group so that the hydroxyl group is prevented from combining with the soluble silica. This action is conspicuous when the treated surface is repeatedly wetted and dried.

The present invention thus differs from the Asai et al. reference in which a water repellent treatment is merely applied to a surface so that stain is repelled with water.

The sanitary chinaware and the method of stain resistant treatment of each of the dependent claims specify particularly distinguished effects regarding the stain resistant agent. These effects are apparent in high scale, lipstick stain, hairdye stain, wear and alkali resistant tests disclosed in the specification.

The method of stain resistant treatment recited in claim 22 is directed to a regeneration treatment. When the stain resistant treatment in accordance with the present invention is applied to a treated surface which has already been used, the sanitary chinaware to which no stain resistant treatment has previously been applied can be changed to a sanitary chinaware to which a stain resistant treatment has been applied, and the stain resistance of the sanitary chinaware can then be improved.

Accordingly, a high stain resistant effect can be achieved from the sanitary chinaware in accordance with the present invention. Further, according to the stain resistant treatment method of the present invention, the foregoing high stain resistant effect can be applied to the sanitary chinaware.

The Asai et al. reference describes a stain resistant agent having the same composition as the present invention. As mentioned, in the present specification (page 8), the gazette of the above-mentioned publication discloses an example of dimethyl siloxane containing a straight chain combination of a silicon-containing functional group and an alkyl group.

Furthermore, Asai et al. describes that the stain resistant agent is reactive with the inorganic surface. However, the reference is directed to only the provision of a chemical which can merely give high water repellency. The stain resistance in this case is the "falling" characteristic of water drops (e.g. column 6, lines 35-37). Accordingly, the foregoing description merely mentions that the silanol group is reactive with an inorganic surface, the strong acid improves the reactivity of the chemicals of formula (I) and formula (II) with the inorganic surface, and the improvement of reactivity gives high durability such that the effect is maintained for a long period of time. Asai et al. does not

disclose or suggest that a silicon-containing functional group is previously combined with a hydroxyl group so that the hydroxyl group is prevented from combining with stain components.

In other words, the reference is directed to mere water repellency and involves stain resistance only in terms of the falling characteristic of water drops. The present invention, however, originates in a glazed surface of sanitary chinaware which is subject to staining when used with water for a long period of time. The subject matter of the present invention is directed to the provision of a high stain resistance against a high amount of scale, etc. thus, differing from the Asai et al. reference.

Furthermore, Asai et al. does not disclose or suggest that previously combining the silicon-containing functional group with the hydroxyl group is effective to prevent combination with stain components, nor does the reference disclose or suggest that the stain is formed through the combination of the hydroxyl group on the treated surface with metal ions such as soluble silica in the water.

The present invention as claimed cannot be achieved from the technique described in Asai et al., and furthermore, the present invention achieves a good effect against high scale, etc. present on a treated surface which is repeatedly wetted and dried, which is an advantage over the technique described in Asai et al.

For these reasons, Applicants take the position that the presently claimed invention is patentable over the Asai et al. reference.

Therefore, in view of the foregoing amendments and remarks, it is submitted that each of the grounds of objection and rejection set forth by the Examiner has been overcome, and that the application is in condition for allowance. Such allowance is solicited.

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resistances by a small critical surface tension of the alkyl group.

The stain resistant agent does not preferably contain any terminal alkali group combining with the silicon-containing functional group. Results of experiments conducted by the inventors show that this can achieve large scale, hairdye, wear and alkali resistances.

From the viewpoint of the wear resistance, a methyl group may be employed as the alkyl group. On the other hand, a propyl or hexyl group may be employed as the alkyl group from the viewpoint of alkali. Results of experiments conducted by the inventors show that when the alkyl group is a propyl or hexyl group, the alkyl group is increased. The stain resistant agent is advantageous in the alkali resistance but disadvantageous in the wear resistance. On the other hand, when the alkyl group is a methyl group, the stain resistant agent is advantageous in the wear resistance but disadvantageous in the alkali resistance.

The number of
~~A quantity of the alkyl group is preferably larger than~~
the number of
~~A quantity of the carbon fluoride group when the stain resistant agent contains a terminal carbon fluoride group combining with~~
the silicon-containing functional group and a terminal alkyl group combining with said silicon-containing functional group. Results of experiments conducted by the inventors show that the stain resistant agent does not contain only perfluoroalkylsilane. Consequently, the stain resistant agent has high lipstick stain and wear resistances.

the number of
~~A quantity of the carbon fluoride group~~
the number of
~~A quantity of the alkyl group when the stain resistant agent contains a terminal carbon fluoride group~~

combining with the silicon-containing functional group and a terminal alkyl group combining with said silicon-containing functional group. Results of experiments conducted by the inventors show that this increases perfluoroalkylsilane, 5 resulting in high scale, hairdye, wear and alkali resistances.

The silicon-containing functional group and the alkyl group are preferably combined with each other by dimethyl siloxane ($O-Si(CH_3)_2$). Results of experiments conducted by the inventors show that this results in high scale, hairdye, wear and alkali 10 resistances.

The dimethyl siloxane preferably contains a straight chain combination of a silicon-containing functional group and an alkyl group or an annular combination of the silicon-containing functional group and the alkyl group. Results of experiments 15 conducted by the inventors show that this results in stably high scale, hairdye, wear and alkali resistances.

As one example of the straight chain combination of the silicon-containing functional group and the alkyl group, an stain 20 resistant agent containing a mixture of a first agent and a second agent described in Japanese Patent Application Publication No. 8-209118 (1996) may be employed. The first agent is a co-hydrolysate of an organic silicon compound containing a perphloroalkyl group and a methylpolysiloxane compound containing a hydrolytic group in a hydrophilic solvent, whereas 25 the second agent is a mixture of organopolysiloxane and a strong acid. More specifically, the first agent is a co-hydrolysate of $C_8F_{17}CH_2CH_2Si(OCH_3)_3$ and $Si(CH_3O)_3CH_2CH_2-(Si(CH_3)_2O)_{10}-Si(CH_3)_2CH_2CH_2Si(OCH_3)_3$ in a

hydrophilic solvent containing a solution of 0.1N-hydrochloric acid, t-butanol and hexane. The second agent is a mixture of HO-(Si(CH₃)₂O)₃₀-Si(CH₃)₂OH and methanesulfonic acid.

A large effect can be achieved in a case where the treated surface is repeatedly wetted and dried. In a portion repeatedly wetted and dried, a metal ion in the water easily combines with a hydroxyl group, whereupon stain tends to be produced. In this meaning, the ceramic product of the present invention is effective when it is a Western style flush toilet, a Japanese style flush toilet, a flush toilet for men or a basin.

An antibacterial treatment may be applied to portions other than the treated surface.

When the stain resistant treatment of the present invention is applied to ~~an already used~~ ^a ~~treated surface,~~ ^{which has already been stained} a ceramic product to which no stain resistant treatment has been applied can be changed to a treated ceramic product, or the reduced stain resistant effect of the ceramic product can be improved.

The method preferably comprises a pretreatment step of reproducing a hydroxyl group on the treated surface. Consequently, the layer can exhibit high durability. As the pretreatment step, the treated surface may be rubbed using an abrasive or acid ammonium fluoride or hydrofluoric acid may be applied to the treated surface and thereafter, the treated surface may be washed in order that stain due to silicic acid (stain due to scale) may be eliminated. Furthermore, the pretreatment step may include a first step where the treated surface is washed with an acid liquid so that stain due to urine is eliminated and a second step where the treated surface is rubbed using an abrasive.

subsequent to the first step, or acid ammonium fluoride or hydrofluoric acid is applied to the treated surface and thereafter, the treated surface is washed so that stain due to silicic acid (stain due to scale) is eliminated.

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BRIEF DESCRIPTION OF THE DRAWINGS

Other objects, features, and advantages of the present invention will become clear upon reviewing the following 10 description of the preferred embodiments, made with reference to the accompanying drawings, in which:

FIGS. 1A and 1B show a chemical formula of a stainproofing agent and a schematic structure of a layer comprising the stainproofing agent concerning test 1 respectively; *(2nd)* *resistant*

15 FIGS. 2A and 2B show a chemical formula of a stainproofing agent and a schematic structure of a layer comprising the stainproofing agent concerning test 2 respectively; *resistant*

FIGS. 3A and 3B show a chemical formula of a stainproofing agent and a schematic structure of a layer comprising the stainproofing agent concerning test 3 respectively; *resistant*

20 FIGS. 4A and 4B show a chemical formula of a stainproofing agent and a schematic structure of a layer comprising the stainproofing agent concerning test 4 respectively; *resistant*

FIGS. 5A and 5B show a chemical formula of a stainproofing agent and a schematic structure of a layer comprising the stainproofing agent concerning test 5 respectively; *resistant*

25 FIGS. 6A and 6B show a chemical formula of a stainproofing agent and a schematic structure of a layer comprising the stainproofing agent concerning test 6 respectively; *resistant*

- ✓ *resistant*
stainproofing agent concerning test 6 respectively;
- ✓ *resistant*
FIGS. 7A and 7B show a chemical formula of a stainproofing
agent and a schematic structure of a layer comprising the
stainproofing agent concerning test 7 respectively;
- ✓ *resistant*
5 FIGS. 8A and 8B show a chemical formula of a stainproofing
agent and a schematic structure of a layer comprising the
stainproofing agent concerning test 8 respectively;
- ✓ *resistant*
FIGS. 9A and 9B show a chemical formula of a stainproofing
agent and a schematic structure of a layer comprising the
10 *resistant* stainproofing agent concerning test 9 respectively;
- ✓ *resistant*
FIGS. 10A and 10B show a chemical formula of a stainproofing
agent and a schematic structure of a layer comprising the
stainproofing agent concerning test 10 respectively;
- ✓ *resistant*
FIGS. 11A and 11B show a chemical formula of a stainproofing
15 agent and a schematic structure of a layer comprising the
stainproofing agent concerning test 11 respectively;
- ✓ *resistant*
FIGS. 12A and 12B show a chemical formula of a stainproofing
agent and a schematic structure of a layer comprising the
stainproofing agent concerning test 12 respectively;
- ✓ *resistant*
20 FIGS. 13A and 13B show a chemical formula of a stainproofing
agent and a schematic structure of a layer comprising the
stainproofing agent concerning test 13 respectively;
- ✓ *resistant*
FIGS. 14A and 14B show a chemical formula of a stainproofing
agent and a schematic structure of a layer comprising the
25 stainproofing agent concerning test 14 respectively;
- ✓ *resistant*
FIGS. 15A and 15B show a chemical formula of a stainproofing
agent and a schematic structure of a layer comprising the
stainproofing agent concerning test 15 respectively;

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1. (Amended) A [ceramic product] sanitary chinaware intended to be repeatedly wetted and dried during use, said sanitary chinaware having a treated surface formed with a layer [composed of] comprising a stain resistant agent, said agent including a silicon-containing functional group, previously combined, by dehydration or dehydrogenation prior to said repeated wetting and drying, [combining] with a hydroxyl group which is combinable with soluble silica and which is present on said treated surface [by dehydration or dehydrogenation].

2. (Amended) The [ceramic product] sanitary chinaware according to claim 1, wherein the silicon-containing functional group does not combine with another silicon-containing functional group.

3. (Amended) The [ceramic product] sanitary chinaware according to claim 1 or 2, wherein the stain resistant agent contains a terminal carbon fluoride group [combining] combined with the silicon-containing functional group.

4. (Amended) The [ceramic product] sanitary chinaware according to claim 3, wherein the carbon fluoride group is $-C_nF_{2n+1}$ where n is a natural number in a range of $1 \leq n \leq 12$.

5. (Amended) The [ceramic product] sanitary chinaware according to claim 1 or 2, wherein the stain resistant agent contains a terminal carbon fluoride group [combining] combined with the silicon-containing functional group and a terminal alkyl group [combining] combined with said silicon-containing functional group, and the number of terminal alkyl groups is larger than the number of terminal carbon fluoride groups [said alkyl group has a larger quantity than said carbon fluoride group].

6. (Amended) The [ceramic product] sanitary chinaware according to claim 1 or 2, wherein the stain resistant agent contains a terminal carbon fluoride group [combining] combined with the silicon-containing functional group and a terminal alkyl group [combining] combined with said silicon-containing functional group, and the number of terminal carbon fluoride groups is larger than

the number of terminal alkyl groups [said carbon fluoride group has a larger quantity than said alkyl group].

7. (Amended) The [ceramic product] sanitary chinaware according to claim 5, wherein the silicon-containing functional group and the alkyl group are combined with each other by dimethyl siloxane.

8. (Amended) The [ceramic product] sanitary chinaware according to claim 6, wherein the silicon-containing functional group and the alkyl group are combined with each other by dimethyl siloxane.

9. (Amended) The [ceramic product] sanitary chinaware according to claim 7, wherein the stain resistant agent is a mixture of a first agent and a second agent, said first agent being a co-hydrolysate of an organic silicon compound containing a [perphloroalkyl] perfluoroalkyl group and a methylpolysiloxane compound containing a hydrolytic group in a hydrophilic solvent, said second agent being a mixture of organopolysiloxane and a strong acid.

10. (Amended) The [ceramic product] sanitary chinaware according to claim 9, wherein the dimethyl siloxane contains a straight chain combination of the silicon-containing functional group and the alkyl group.

12. (Amended) A method of stain resistant treatment applied to a [ceramic product] sanitary chinaware to be used with water and having a treated surface [on which a layer comprising] having a hydroxyl group combinable with soluble silica, and which treated surface is to be repeatedly wetted and dried, which method comprises applying a stain resistant agent [is formed so that said stain resistant treatment is applied to the ceramic product, said stain resistant agent including a] including a silicon-containing functional group on said treated surface, and combining said silicon-containing functional group [combining] with [a] said hydroxyl group present on the treated surface by dehydration or dehydrogenation.

14. (Amended) The method according to claim 12 or 13, wherein the stain resistant agent contains a terminal carbon fluoride group [combining] combined with the silicon-containing functional group.

16. (Amended) The method according to claim 12 or 13, wherein the stain resistant agent contains a terminal carbon fluoride group [combining] combined with the silicon-containing functional group and a terminal alkyl group [combining] combined with said silicon-containing functional group, and the number of terminal alkyl groups is larger than the number of terminal carbon fluoride groups [said alkyl group has a larger quantity than said carbon fluoride group].

17. (Amended) The method according to claim 12 or 13, wherein the stain resistant agent contains a terminal carbon fluoride group [combining] combined with the silicon-containing functional group and a terminal alkyl group [combining] combined with said silicon-containing functional group, and the number of terminal carbon fluoride groups is larger than the number of terminal alkyl groups [said carbon fluoride group has a larger quantity than said alkyl group].

20. (Amended) The method according to claim 18, wherein the stain resistant agent is a mixture of a first agent and a second agent, said first agent being a co-hydrolysate of an organic silicon compound containing a [perphloroalkyl] perfluoroalkyl group and a methylpolysiloxane compound containing a hydrolytic group in a hydrophilic solvent, said second agent being a mixture of organopolysiloxane and a strong acid.

22. (Amended) The method according to claim 12, wherein the treated surface to which the stain resistant agent is to be applied has already been used such that the treated surface is a stained surface.

23. (Amended) The method according to claim 22, further comprising a pretreatment step of reproducing a hydroxyl group on the treated surface.